CHAPTER 7.
MAINTENANCE INSPECTION AND SERVICES

Section 1. GENERAL

7-1. Purpose.

Chapters 1 through 6 of this manual describe procedures for effectively maintaining trackage systems at military installations. The planning and developing of an effective track maintenance program must be based on thorough and timely track inspections by competent inspectors. This chapter describes procedures for inspecting trackage systems and systematically detecting, identifying, and reporting deficiences and trouble areas within those systems. Inspection criteria shall be formulated by the ruling activity based on but not necessarily limited to the standards shown in Appendix B.

7-2. Responsibility.

Providing qualified trackage inspection at each military installation is the responsibility of the department tasked with the maintenance of the trackage and other real property as shown in Chapter 1. In making inspection, as in performing maintenance and repair work, the safety precautions of Chapters 1 and 6 of this manual must be observed.

7-3. Inspection of Railroad and Crane Trackage.

Railroad and crane trackage inspections shall be performed at the frequencies and in the detail specified by agency policy. In general, inspections shall consist of observing and functioning of the trackage as related to safety, maintenance, and design parameters. Examination will be by sight, sound, feel, instrumentation, and nondestructive testing. Inspection of trackage includes rails, ties, subgrade, supports, foundations, drainage appendages, and accessories. Primary emphasis shall be given to insuring maximum safety by maintaining all facilities in a safe and sound condition. Deviations from the standards set forth herein shall be approved by waiver from the appropriate service (see Chapter 1).

7-3.1. Preparation. Prior to the investigation of a segment of crane or railroad trackage the inspector shall become familiar with as many available factors of the operation as possible. All pertinent information and data available should be reviewed. These may include results of previous investigations, statistical information on safety performance, and causal factors of accidents determined in accident investigations. Ommission, deletion, or uncorrected defects noted on these previous reports give clues to the inspector on locations where detailed investigations may be required. In addition, to save time and facilitate a more complete investigation, as well as to gain the cooperation of the activity, the following preparations should be made: (1) notify the personnel responsible for the track and those responsible for operations over the track in the territory to be inspected, and (2) set a date and location for the start of the inspection. If time permits, secure the following information from the activity in advance of the investigation:

7-3.1.1. Timetables and special instructions covering territory to be inspected, showing method of operation, maximum allowable speeds, permanent speed restrictions, equipment, and loading restrictions.

7-3.1.2. Trains or cranes per day in each direction, average tonnage, and amount of hazardous materials movement.

7-3.1.3. Locations, speeds, and reason for existing temporary slow orders.

7-3.2. Inspection.

7-3.2.1. Duties of Inspector. The inspector's primary duty is to conduct effective investigations to determine whether the crane or railroad trackage is complying with the safety standards and regulations. Effective investigation requires identification, professional evaluation, and accurate reporting of safety conditions and practices. Inspections may vary considerably in scope and detail, depending upon the circumstances in each case.

7-3.2.2. Records. The examination of records, of track components, and the measurement of track geometry for the determination of compliance with requirements are the responsibility of the inspector.

7–3.2.3. Personal Safety. The inspector's first concern is his own personal safety, as well as the safety of any personnel accompanying him. He will make sure he has current lineup of all train, crane, or other equipment movement and has permission to occupy designated tracks between designated times. When afoot on the railroad track, he must always be alert, expect a train on any track at any time in either direction, and be prepared to promptly clear such train. Extra personal care must be exercised under adverse weather conditions.

7–3.2.4. Safety Rules. The inspectors should know and comply with the safety rules of the installation. They will also wear the safety equipment specified by the activity.

7–3.3. Advanced Notice of Investigation.

7–3.3.1. Schedules Inspection. Since the efficiency and safety of an inspection can be significantly improved by the assistance of operating personnel, advance notice of investigation will be given in all cases where feasible. The inspectors should give ample notice of the territory to be investigated, a proposed date for starting this investigation and an invitation to have a representative of the activity accompany them on the investigation. The activities representative should have immediate knowledge of all conditions noted by previous inspections and can assist in providing accurate locations or distances to named locations and furnish proper track designations.

7–3.3.2. Time Frame. Sufficient time should be provided in planning an investigation to allow activity representatives to prepare themselves and/or permit reasonable adjustments to be made in the schedule.

7–3.3.3. Unscheduled Inspection. These instructions, however, are not to be construed to prohibit unaccompanied investigations when other activity personnel are unavailable to furnish assistance.

7–3.4. Inspection Equipment and Tools. In order to make a proper track inspection, certain tools and equipment are necessary. The basic equipment needed is a track level and gage, a frog gage for rigid frogs, a hammer for sounding rail in paved areas, a rule, a cord 62 feet long, report forms, and a copy of this manual.

Section 2. INSPECTION AND REPORTING

7–4. Categories of Inspection.

7–4.1. Continuous Operator Inspection. Daily or prior to use, safety checks listed in activity regulations shall be conducted. In addition, on-the-job observations shall be going on at all times when equipment is working. Crane and railroad operations personnel (operators, engineers, trackmen, riggers, etc.) shall be encouraged to observe and report track problems, deficiencies, obstructions, and the "feel" of the track. When walking down the track, the inspector/operator can look for broken rails and other rail defects, faulty switch-point closures, indications of wide gauge, poor line or surface, loose crossing planks, wheel flanges striking frog points, working spikes and joints, pull-aparts, evidence of the imminence of track buckling, scour at bridges, and the threat of slides. All these things can contribute to train accidents and should be brought to the attention of the responsible person for correction.

7–4.2. Preventive Maintenance Inspection. Preventive maintenance (PM) inspection is a visual, continuous routine (shop level) working-inspection. It is performed in conjunction with daily assigned maintenance and repair tasks. *When possible, deficiencies are corrected during the inspection and no record made.* Uncorrected deficiencies shall be reported to the supervisor for action, inclusion in the repair work schedule, adjustment of operating speed, and/or closure of section of trackage.

7–4.2.1. The PM inspection is designed to detect and correct those trackage deficiencies that develop from day to day. If the track walker can correct an observed deficiency in a half-hour or less, it should be done; if not, it must be reported. From these reports, the essential trackage maintenance and repair work schedules are developed and implemented.

7–4.2.2. The types of deficiencies PM inspection is designed to detect, and which the track walker may be able to correct include but are not limited to: insufficient switch lubrication; shortage of or lack of fuel and untrimmed wicks in lighted switch targets; loose or missing joint bolts, rail spikes, plates, or anchors; condition of derails and wheel locks; ice or debris-fouling switches and flangeways in paved areas; defective bumper blocks; and poor housekeeping (para 6–4). Uncorrected items may include but are not limited to: broken ties, defective switch points, inoperative switches, operator reported rough or soft spots, poor drainage, substructure failure, defective rail, settlement, condition of supporting columns, and misalignment. The most important sections to be checked are the switches, curves, and any area where a derailment has occurred.

7–4.3. Overall Track Inspection. Because overall track inspections of trackage are more inclusive and exacting than the PM inspections, only qualified personnel should be assigned to make them. Annual inspections are required except where snow, ice, and

subfreezing temperatures or unusual climatic conditions are an important factor. In these circumstances overall track inspections should be scheduled more frequently. Where winters are a significant maintenance factor, one overall track inspection is scheduled in the early fall or late summer and one soon after the spring thaws. Reports of overall track inspections are used: (1) to plan the immediate work needed to prepare for and to recover from the effects of winter; (2) to determine if a condition exists that requires engineering investigation, additional testing, or evaluation; (3) to develop the several annual reports of trackage work and the single or multiyear maintenance plans required; and (4) as the basis of Backlog of Maintenance Reports.

7–4.3.1. Methods of Detection. Overall track inspections should include all checks performed during the PM inspections plus all other detectable deficiencies. Visual inspections should include observations of all readily accessible components of the trackage system including rails, ties, rail accessories, switches, crossovers, ballast roadbeds, support structures, and appurtenances. Basic checkpoints for trackage inspection are listed in Chapter 6 and Appendix B. Using the inspection reports and relating them to the installation's basic trackage requirements, its in-house capabilities, priorities, available funding, and other factors, the annual and the long-range trackage maintenance and repair programs are developed and programmed. Also, these reports can be a factor in the development of future trackage programs. Since all rail flaws are not visible to the eye, rail inspection that will detect internal flaws is significant (para 3–14 and 7–5) to an overall track inspection. The detection of internal rail flaws by a detector car has been standard practice on American railroads for a number of years. These cars use both the induction and ultrasonic methods. The cars are available by contract on an hourly rental basis. An overall track inspection report of running track cannot be completely comprehensive without the inclusion of a report showing the results of nondestructive rail tests.

7–4.3.2. Checklists and Reporting. Provide overall track inspectors with checklists that include, but are not necessarily limited to, all the types of deficiencies included in paragraph 6–5.2 and Appendix B. The inspectors will report in detail the condition of all the trackage and track elements. Their reports will recommend the priority(s) of work and the best method(s) of correcting reported deficiencies. Exceptionally complex and/or unusual trackage maintenance/repair problems may have to be subjected to in-depth engineering review for best resolution.

7–4.3.3. Classification of Hazards. Inspectors should designate the degree of hazard (negligible, marginal, critical, or catastrophic, see para 7–8.1) as required by the reference in Chapter 6 based on their judgment. Where there is a doubt regarding the seriousness of a defect, or a questionable safety condition, use shall be stopped over the section of trackage involved until the deficiencies are corrected or until safe use has been determined. Deficiencies designated as critical or catastrophic by inspection personnel shall be evaluated by the cognizant engineering or maintenance organization to determine corrective action and interim precautionary measures including use-restrictions.

7–4.3.4. Support Structures. All subgrades, ballast, foundations, and bridges or trestles shall be inspected for signs of settlement or failure. Special attention should be given to looking for openings in quaywalls, bulkheads, or other waterfront retaining structures that may permit fill material to wash out and cause trackage settlement and failure. Buildings supporting elevated cranes shall be inspected in accordance with designated criteria.

7–4.3.5. Paved Areas. In asphalt, concrete, or grouted areas visual inspection shall include observations for exposed rail defects, trackage movements exceeding the limits stated herein, and signs of distress in adjacent pavement. Potentially serious defects or suspected failures shall be cause for removal of paving and a detailed investigation of trackage. Pavement shall be maintained so that it does not interfere with railroad or crane operation and to insure safe vehicle movement.

7–4.3.6. Measurements. Visual observations or spot-check measurements shall be made of grade, track gage, cross-section elevation, curve radius, horizontal alignment, vertical mismatch, supports, and other features to insure that appropriate criteria are met. Instrument surveys may be requested by the inspector to verify visual observations or spot-check measurements, establish new alignment, investigate problem areas, and/or determine deviation from the established standards.

7–4.3.7. Track Geometry. Horizontal alignment, grade, cross-section elevation, and/or gage shall be investigated when any of the following conditions exist:

7–4.3.7.1. There are indications of abnormal wear on the railheads or on wheel flanges.

7–4.3.7.2. New rails are being installed or any portion of a rail is realigned.

7–4.3.7.3. Operating crane or railroad engine bind have difficulty in starting or have trouble with movement.

7–4.3.7.4. When a potential deficiency of trackage can be observed, heard, or felt.

7–4.3.7.5. There are indications of substructure settlement, failure, or other structural changes.

7-4.3.7.6. Visual observations indicate that the acceptable limits may exceed those limits established by the activity.

7-4.3.7.7. Tests, inspection, experience, or engineering judgment indicate operation or rail alignment problems.

7-4.4. Optional Operational Observations. An operational observation is the observation of engine, crane or car working on the trackage system. The purpose of an operational inspection is to assist in the identification of problem areas which could develop into unsafe trackage. Conditions which may be discovered include the following: (1) soft spots in the ballast; (2) weak or disintegrated ties; (3) looseness, binding, or vibration; and (4) from our off-track, generally downgrade, position we can look for "daylight" under wheel treads and other evidence of wheels trying to climb the rails, as well as for dragging equipment.

7-4.4.1. Frequency. Operational inspections on active trackage systems shall be performed at irregular intervals to insure that the trackage systems will sustain the prescribed load in a safe manner. Railroad sidings, storage trackage, and sections of crane or railroad trackage blocked or seldom used should have operational inspections within a maximum interval of five years. However, visual observation of trackage during routine traffic loading after repair and during investigations is recommended. Low-use trackage serving hazardous loads such as ordnance or fuel shall have an operational inspection within 2 years prior to use.

7-4.4.2. Routine Traffic Observations. Trackage shall be inspected while equipment is operating. Observations for looseness, binding, deflection, or vibration shall be made by sight, sound, and feel. In addition, rail joints, ties, tie plates, ballast or grout, general alignment, rail condition, supporting structures, and other accessories may be observed for deficiencies during operational inspection. Observations may be made (1) during routine annual inspections, (2) by operators in conjunction with daily safety checks, (3) by maintenance-of-way supervisor from the lead car or engine, or (4) by inspectors adjacent to the trackage. When the operational inspection is performed onboard a train or engine, supplemental observations of passing rail traffic at randomly selected and suspected defective areas shall be made. There is no requirement for physical measurements of rail or trackage systems under load; however, when practical and accessible, rail systems shall be observed for deflection. Guidelines for maximum allowable deflections as established by the inspection shall be determined by visual judgment. In the event unusual movement is observed or felt, deflections appear to be larger than the guideline limits established, or the cause of deficiency cannot be immediately determined, an investigation and engineering analysis of the immediate vicinity shall be made prior to determining the degree of hazard. Results of the investigation and engineering analysis, not the deflection limit per se, shall determine when use of a section of trackage must be discontinued.

7-4.4.3. Loads. Loads defined below should be moved over track systems slowly enough so that observations can be made.

7-4.4.3.1. Railroad Trackage. Loads on rails shall be provided by routine rail traffic that normally operates on the track. If a typical train is not observed, the load on the rail may be provided by a locomotive, engine, or test car. When a test car is used, it shall be loaded to give the maximum anticipated load on at least one axle and as close to the total anticipated load as practical.

7-4.4.3.2. Ground-Level Crane Trackage. The operational inspection shall be conducted by using the heaviest crane or the crane with the largest wheel load that can operate on the track. **NOTE:** The inspection may be conducted with no load on the hook and with the boom parallel to the track.

7-4.4.3.3. Elevated Crane Trackage. Elevated crane trackage systems shall be inspected after completion of each crane load test. Sections of elevated crane rail trackage not observed during crane load tests shall be observed during the operation of the heaviest crane that can operate on the track with no load on the hook and the trolley positioned adjacent to the rail being observed.

7-4.5. Interim (Emergency) Inspections. Trackage is often damaged during severe weather. Interim inspections must be made during or immediately following heavy rain, ice, and/or windstorms and extremely high tides or waves. Damage that affects operation safety will be reported immediately.

7-5. Nondestructive Testing.

It is recommended that all active ground-level crane, elevated crane, and railroad rails be tested nondestructively for defects at 5-year intervals, unless maintenance problems or visual inspection dictate a necessity for more frequent testing. Illustrations of defects and criteria for unacceptable rails are included in Chapter 3 and Appendix B. New rail and accessories shall be accepted according to the latest Government specification and/or standard industry practice. The nondestructive test results shall be used to establish a baseline for future inspection and to identify areas requiring observation. Nondestructive testing of new, stockpiled, or relay (used) rail put into service, may be deferred until the next regularly scheduled test at the discretion of the commanding officer. During the interim period, the rail may be

given a safety-use rating based on other tests, observations, and inspections recommended by this manual.

7-5.1. Sounding. Sounding with a hammer is one of the best and least expensive methods of testing rail, and is a practical way to inspect relatively short sections of trackage, elevated crane trackage, and other trackage systems where ultrasonic testing is impractical. Light tapping with a small hammer about every 6 inches will reveal looseness between the rail and anchor plate, and defects before they become serious. Similar to ultrasonic testing, all nonstandard responses should be investigated and recorded for future comparison. This system may be used to test rail when electronic inspection is impractical. However, depending on rail usage, age, history, and experience, the activity should consider using an inspection schedule shorter than the programmed 5-year interval when using sounding as the nondestructive method.

7-5.2. Ultrasonic Testing. Ultrasonic inspection is a nondestructive test method for revealing internal discontinuities in dense homogenous materials by means of acoustic waves of frequencies above the audible range. Ultrasonic testing is the preferred method for nondestructive testing of readily accessible rail. Sonic testing devices, which are available locally or those which are available from commercial sources, can be used for this purpose. Ultrasonic testing is an economical method of checking long lengths of trackage and rail encased in pavement. Ultrasonic testing of new rail may be deferred until the next regularly scheduled 5-year test interval.

7-5.2.1. Calibration. Ultrasonic inspection equipment shall be calibrated to insure reliable interpretation of responses. The approximate smallest defects that can be consistantly detected include, but are not necessarily limited to, the following simulated, "not-serious" defects: (1) a 1/4-inch-diameter hole drilled horizontally through the railhead; (2) a bolt hole through the web; (3) a horizontal 1/2-inch-long sawn crack between the head and the web; and (4) a vertical 1/2-inch-long sawn crack in the web.

7-5.2.2. Test Results. All discontinuities shall be reported, the nature and size of defect estimated, and responses compared with standards or past test results. Rejection or degree of hazard of all potential defects shall be based on assessment of ultrasonic inspection results, visual inspection, experience, engineering judgment, and the criteria established by the activity. In-place welded joints, welded repairs, and rail castings, such as frogs and certain types of swtiches, may have confused or erratic responses when ultrasonically tested; therefore, interpretation requires experience and/or engineering judgment to preclude an erroneous classification of defect.

7-5.3. Other Nondestructive Tests. Magnetic particle (MIL STD 271), dye penetrant, and other nondestructive test methods have limited capability for surface inspections; However, they may be advantageous in investigating potential defects indicated by other inspections. Eddy current or other approved, nondestructive test methods brought about by state-of-the-art advances may be used to supplement or replace sounding or ultrasonic testing based on local conditions, availability, economics, experience, and/or engineering judgment.

7-6. Miscellaneous Inspections and Tests.

Other inspections may be used to determine the safe condition of trackage under unique or unusual circumstances or to make a detailed engineering investigation of specific, critical components of a trackage system. The inspections performed and the frequency shall be those considered necessary by the activity or as recommended by the audit. Prior to use, the availability, limitations, and practicability of any special investigation shall be evaluated. Special inspections, such as the following, may assist in determining the condition of trackage:

7-6.1. Building Inspection. Review comments made by the building/structural inspector to verify that work affecting trackage has been scheduled.

7-6.2. Underwater Damage Assessment Television System. Divers or the Underwater Damage Assessment Television System may be required to conduct underwater inspections of waterfront containment structures (bulkheads) and dock pilings supporting trackage.

7-6.3. Seismograph. Under certain conditions seismographic instruments may be beneficial in determining voids in fill material or embankments, level of water tables, or location of slippage planes in the foundation below trackage systems.

7-6.4. Strain Gages. When the structural analysis for the anticipated maximum loading of a structure indicates certain members may be overstressed or marginal, a load test (duplicating or exceeding maximum total moment and shear experienced in-service) with stress and strain instrumentation is appropriate.

7-7. Track Records.

Up-to-date records of all trackage at each military installation are basic to the administration of trackage maintenance and repair programs. As in every type of inspection, the thoroughness with which trackage inspections are made is important. Of equal importance is the accuracy and thoroughness with which the inspection reports are prepared. Deficiencies in track elements such as switches, bridges, culverts, and road crossings will be identified and reported.

Deficiencies in hard to identify elements such as individual ties, joints, and rails will be summarized in the reports. Field identification of those deficiencies will be accomplished by durable markings; for example, each tie to be replaced is indicated by inspector-applied markings. (See Figures 3-20 and 3-21 in paragraph 3-11.3.) In order to manage and administer trackage inspections, maintenance programs, and design, the following information should be available in a usable condition so that it may be referred to easily and readily. Where documents do not exist, a long-range program should be established to obtain the appropriate information for retention in activity files.

7-7.1. Inspection Reports. Inspection reports should be filed and maintained in accordance with current directives. If track charts (Appendix E, Figure E-1) are used, the inspection report form should reference a track chart. Each inspection report should record the inspection findings of only a specific segment of track. When track charts are used, only that track shown on the referenced track chart should be reported. Where more detailed reports are required than can be shown in the limited space provided in the inspection report form, the form may be supplemented with photographs and other supporting material. Until reported deficiencies have been corrected, it is essential that the reports and appropriate supporting material be conveniently accessible, in accordance with current directives. The current degree of hazard for each section of trackage shall be shown on the track chart, map, or other prominent document.

7-7.2. Track Charts. Track charts, although not required by all departments, are a useful tool in scheduling maintenance and repair work and for indicating areas of important track elements that require other than the usual amount of maintenance and repair. Track charts or plans should be maintained as part of the real property records. The charts or plans shall be kept up to date and used for programming future work, scheduling current work, indicating abnormal conditions, and recording maintenance and inspection data. Charts or plans can be in any format and shall be usable as a working document. Curve data shall be recorded for all curves.

7-7.3. Plan and Profile. Detailed plan and top of rail profile or grades of crane and railroad track systems should be kept current and may be shown on the track chart or separately. Size and type of rail, switches, degree of curve, frogs, and other rail appurtenances should be indicated on the plan. Reference points for location and elevation checkes should be accurately referenced.

7-7.4. Cross Section. Cross sections of substructures shall be maintained, when known and available, especially the investigation reports of substructures under crane or railroad tracks around piers, drydocks, trestles, wet areas, and the major supporting substructures of elevated cranes.

7-7.5. Historical Data. Historical data on each system shall be retained or developed and include the following: (1) dates that the system was installed; (2) weight of rail, gage of track; (3) history of maintenance and repair; (4) replacement of rail; (5) methods of accomplishing previous work; (6) general overall trackage condition; (7) maximum capacity; (8) original intent or use of trackage; (9) engineering calculations to establish maximum loading; (10) HQ approval of railroad curves with radii less than 300 feet; (11) justification of exceptions to standards, waivers; (12) valid structural analysis for all supporting structures based on or exceeding current maximum loading; and (13) other pertinent information.

7-7.6. Proposed Projects. Maintain a list of pending work including: (1) major repair projects (approved, submitted, and needed), (2) minor work to be accomplished with local funding, and (3) major replacement projects which are being considered for MCON funding. Use "multiyear" renewal program for rail replacement when practical.

7-7.7. PM Inspection Reports. Local formats in existence may be used. As a minimum, PM inspection reports should include: (1) date, (2) sections of trackage inspected, (3) unrepaired deficiencies, (4) number of and size of broken or missing parts, (5) suspected misalignment or defect, and (6) guides and instructions used for the inspection. The current PM inspection report and the one for the preceding period shall be retained. Work authorization documents or shop repair orders, usually the action following PM inspections, shall be kept for 5 years.

7-7.8. Overall Track Inspection. As a minimum, activity track files shall contain the latest complete control inspection report, supplemental engineering inspection reports, and all engineering investigation reports made since the last complete annual or special report. Modification and alteration approvals including engineering investigations and field checks shall be kept for 5 years. Current operational inspection records shall be kept until superseded.

7-7.9 Nondestructive Testing. Current nondestructive test records shall be kept on file for all rails. Data collected from the ultrasonic or induction tests shall be retained as necessary for baseline and defect growth comparisons. A narrative report should be included to explain any unusual observations.

7-7.10. Program Review Report. The program review, HQ/command assistance, or IG inspection report and activity responses shall be retained until superseded.

7–8. Inspection Check Points.

The types of deficiencies inspectors are required to note are described in Chapters 1 through 5 and Appendix B of this manual. The day-to-day deficiencies PM inspectors are expected to note are relatively few in number, and all are quite simple to detect. They are mentioned in paragraph 7–4.2. Engineering inspections and interim inspections should note and report all the types of deficiencies covered by PM inspections, plus all of the other shortcomings of trackage that are described in Chapters 1 through 5 and Appendix B of this manual. Careful visual inspections can detect many of the shortcomings; others are more complex and can be detected only by certain techniques.

7–8.1. Degree of Hazard. A *hazard* is any real or potential condition that can cause injury or death to personnel, or damage to or loss of equipment or property. *All* trackage should be classified according to one of the four categories shown below. Certification shall be made on sections of trackage at intervals not to exceed 2 years. Overall track inspections (para 7–4.3) shall be used as the basis for determining the degree of hazard. Tests of inspections made between overall track inspections that indicate previously unreported critical or catastrophic defects or other unsafe conditions shall automatically cancel the existing degree of hazard over the specific section of trackage involved. For inactive trackage or trackage used infrequently, the inspection and hazard level determination may be performed just prior to use. When there is any doubt as to the degree of hazard over a given section of trackage, the degree of hazard shall not be made until a detailed investigation and engineering evaluation has been completed to determine whether or not the section of trackage involved can be certified safe or whether or not restricted operations may continue pending repair.

7–8.2. Hazard Level Category. Hazard level is a qualitative measure of hazards stated in relative terms. For purposes of this standard, the following categories of hazard levels are defined and established: personnel error, environment, design characteristics, procedural deficiencies, or subsystem or component failure or malfunction (para 6–1 and MIL-STD-882A).

Category	Hazard Level
Negligible	Will not result in personnel injury or system damage. Minor defects that will not affect operation over trackage systems.
Marginal	Can be counteracted or controlled without injury to personnel or major system damage. Routine maintenance and repairs should be scheduled.
Critical	Will cause personnel injury or major system damage, or will require immediate corrective action for personnel or system survival. Operation over trackage systems must be restricted.
Catastrophic	Will cause death or severe injury to personnel, or system loss. Operation over trackage systems shall be stopped.

7–8.3. Defect Classification. The basic rule of thumb or general guideline for determining a critical hazard of a defective rail and continuing use at DOD installations is 1/4 inch of alignment or movement. All irregularities in top or side rail wear, difference in elevation at breaks or joints, deflections, and movements exceeding 1/4 inch should be investigated. Common rail defects are illustrated in Figure 3–27. Defects are listed in the hazard category in which they normally occur. Exceptions and variations are expected; therefore, experience and/or engineering judgment must be used to determine the degree of hazard for each defect. General guidelines to assist inspectors and engineering investigators in determining the degree of hazard of a defect are described below.

7–8.3.1. Negligible. Deficiencies that are negligible are those which do not affect the safety of operation, such as:

7–8.3.1.1. Defects, such as breaks, fractures, or defective welds, corrected by the application of fully bolted angle bars.

7–8.3.1.2. Damaged rail with temporary repair (complete weld repairs are considered nondefective).

7–8.3.1.3. Weld irregularities.

7–8.3.1.4. Minor mill or mechanical defects.

7–8.3.1.5. Surface scratches or cracks.

7–8.3.1.6. Possible defects on portions of rail systems made from casting, such as frogs and certain types of switches, having confused or erratic readings when ultrasonically tested.

7–8.3.1.7. Other small defects based on activities' investigation, engineering judgment, and/or experience.

7–8.3.2. Marginal. Trackage systems with small defects such as missing nuts, loose spikes, etc., less than specified in Appendix B, shall be repaired, when possible, during regularly scheduled track work operations. Records of unrepaired rail defects and substandard trackage shall be kept current and the trackage continually observed during all future in-

spections to identify any further degradation which might result in defects.

7–8.3.3. Critical. Trackage with critical defects may continue in use provided the operating speed over the defective section is reduced and the defect or defects are carefully inspected at intervals of not more than every 6 months or as prescribed in Appendix B. Trackage systems with critical defects may be scheduled for restricted operation at the discretion of the officer in charge provided all of the following actions are taken:

7–8.3.3.1. Replacement or repair is scheduled.

7–8.3.3.2. Deficient areas are clearly and specifically marked with warning signs when practical, or specified in written instructions and restrictions.

7–8.3.3.3. Operators are informed to proceed with extreme caution.

7–8.3.3.4. Reduced speed operation is approved following an engineering inspection.

7–8.3.3.5. Additional PM inspections or checks of the defect are schedules. (For infrequently used trackage, inspections may be made just prior to use.)

7–8.3.4. Catastrophic. Sections of trackage with catastrophic defects involved shall not be used until repaired, except as noted below. Serious trackage defects include conditions which engineering judgment and experience have determined to be unsafe, and (Appendix B) requiring immediate change out of rail. **NOTE:** Temporary or emergency repair of defective rails may reduce the degree of hazard to critical or marginal depending on the severity of the defect, for example see paragraph 7–8.3.1 above, items a and b. On trackage systems which have catastrophic rail defects or on dangerous or unsafe sections of trackage, general usage shall be stopped until the section(s) of trackage have been repaired or replaced. Sections of trackage that are defective, damaged, misaligned, or otherwise failing to meet the lowest standards established in Appendix B of this manual shall be barricaded or marked with warning signs (when practical) and service discontinued. When necessary to use trackage in the catastrophic category, the officer in charge shall be responsible for safety and visually supervise each operation over the defective sections.